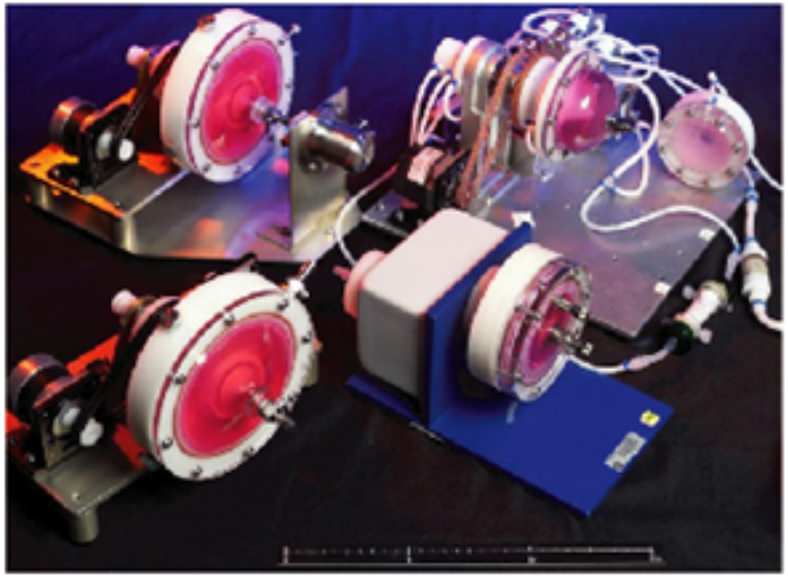
:: HYDRODYNAMIC FOCUSING BIOREACTORS ::

ADVANCED GROUND-BASED MICROGRAVITY ANALOG BIOREACTOR SYSTEMS

Overview



Description

The Hydrodynamic Focusing Bioreactor (HFB) is a rotating, dome-shaped vessel with a centrally located sampling port and an internal rotating spinner. The rotation of the vessel and spinner create a hydrodynamic force within the vessel culture medium. The hydrodynamic force can be modulated by a change in the rotation rates of the vessel and spinner to suspend single cells and large tissue arrays in a low shear fluid environment. A gas-permeable membrane facilitates exchange of gases between the medium and an incubator. The technology has been licensed to Celdyne™ (Houston, TX). A family of HFB systems has been developed to meet the needs of our user scientific community. These include perfused and non-perfused systems with vessel volumes of 40 and 160ml.

Hydrofocusing Bioreactor for Three-Dimensional Cell Culture. Gonda et al. NASA Tech Briefs. 27:66(2003).

NASA Significance

The Cellular Biotechnology Program at the NASA Johnson Space Center has successfully developed microgravity analog bioreactors. These bioreactors enable researchers to investigate some of the effects of modeled microgravity (Space) on cell culture and tissue engineering. Hypotheses arising from investigations using microgravity analog bioreactors are validated in space bioreactors operating aboard the Space Shuttle or International Space Station. The Hydrodynamic Focusing Bioreactor (HFB) is currently under development as a family of ground-based microgravity analog bioreactors. The significant innovation is the controlled generation of a hydrodynamic force to suspend cells and tissues in a low shear fluid environment.

Points of Contact:
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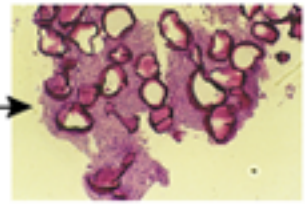
Cell Culture & Tissue Engineering

Anchorage-dependent cells, including primary cells, transformed cells, genetically engineered cells and cell lines, and non-adherent hybridoma cells were successfully cultured either as mono- or co-cultures in the HFB for periods of up to 2 weeks. A variety of attachment materials, including microcarrier beads, scaffolds, and fibers have been successfully used in the HFB for tissue engineering experiments. Average shear values of 0.01 dynes/cm2 were estimated for a rotation rate of 10 rpm - a rate at which large 3D tissue-like assemblies have been suspended.

Tsao Y.D., Pellis N.R., Gonda, S.R. A New Technology for Three-Dimensional Cell Culture: The Hydrodynamic Focusing Bioreactor. 1999 International Mech. Engineer. Congress Symposium. 44: 37-38 (1999).

3D8NK-21 cell assemblies in HFB



3D cellular assemblies on microcarrier beads